THE USE OF SPACED LEARNING AS A PEDAGOGICAL STRATEGY IN ENHANCING STUDENT LEARNING

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ABSTRACT

This conceptual paper attempts to explore the use of Spaced Learning technique as a teaching and learning method. Amidst the rapidly changing technological environment, creating long-term memories is still at the core of education. Spaced Learning is a learning method in which highly condensed learning content is repeated three times, with two 10-minute breaks during which distractor activities such as physical activities are performed by the students. It was suggested that spacing learning over time helps people learn more quickly and remember better. This discussion can serve as a starting point for further dialogues and studies among researchers and educators interested in implementing alternative technique in their teaching and learning activities.

KEYWORDS

Pedagogical Strategy, Spaced Learning, Student Learning, Institutes of Higher Learning

1. INTRODUCTION

Creating long-term memories is important in education. Yet it wasn't until 2005 that a key discovery was published in *Scientific American* explaining how long-term memories are formed in the brain (Fields 2005). Fields found that constant stimulation of the brain cell did not make the brain switch on. The length of cell stimulation was not vital for long-term memories, but the gap between stimulation was. This is known as Spaced Learning.

Taking on the findings of this discovery, Kelley and Whatson (2013) had conducted a study on 440 students aged between 13-15 in an urban secondary school in England. The study was conducted in order to identify whether repeated stimuli separated by timed spaces without stimuli can initiate Long-Term Potentiation (LTP) and Long-Term Memory (LTM) encoding. LTP is a persistent strengthening of synapses in the brain based on recent patterns of activity. These are patterns of synaptic activity that produce a long-lasting increase in signal transmission between two neurons (Nicoll 2017). LTM is typically used to make sense of and give meaning to what you are doing now. However, it is also the repository for more permanent knowledge and skills and includes all things in memory that are not currently being used but which are needed to enable understanding (De Bruyckere, Kirschner & Hulshof 2015).

Using a formula of 10-minute breaks between three intensive sessions of 15-20 minutes teaching, Kelley and Whatson (2013) found that Spaced Learning is more efficient in comparison to standard teaching. For each of the three 15-20 minutes intensive sessions, teaching materials were repeated but presented differently, deepening and extending it. During the 10 minute breaks, distracter activities such as juggling, or throwing balls were carried out. When compared between the experiment group who were taught using the Spaced Learning technique for one-hour, with the control group who learned the same topic for four months, the findings showed no significant difference in student achievement. This means that using Spaced Learning, students were able to achieve the same result as the group of students who studied using typical teaching methods for four months.

2. GENERATIONAL LEARNING STYLES

Aside from the different cognitive style and preferences, learning styles are also different based on the year someone is born. Lindsey Pollak (2017), who is one of the leading expert on millennial and multigenerational workplace have categorised the different generations into five category: Traditionalist (born approximately 1922-1945), Baby Boomers (born approximately 1946-1964), Generation X (born approximately 1965-1980), Generation Y (born approximately 1981-1997) and Generation Z (born since 1998). For Baby Boomers, a teacher should value their experience, challenge them to make a difference, and give lots of positive feedbacks (Coates 2007). For Generation X, teachers should put all relevant information up front as Generation X usually will not read the details. They are the tech-pioneers. To communicate with Generation X, one must be direct and be brief as possible to convey what is needed. They are independent and self-reliant thus they do not like to be micro-managed. Generation Y on the other hand are very tech-savvy. They prefer communication through texting and social media. They love multi-tasking, group work and collaborative learning. They have short attention span, so provide a brief change of pace every 20 minutes to assist with processing and assimilation of information (Coates 2007). Finally, Generation Z is a generation whom never experienced life before the Internet. They were accustomed to multimedia and doing everything at the same time. Generation Z youth have become accustomed to interacting and communicating in a world that is connected at all times (Turner 2015).

In their study, Chun, Dudoit, Fujihara, Gerschenson, Kennedy, Koanui, Ogata and Stearns (2016) found that Generation Z usually have a short attention span. These generations have a noticeably low ability to concentrate and focus on longer, more complex or involved problems in learning. They were also used to have easy access to information at the palm of their hand, where they could get results and feedback instantly. They often not want to spend time doing in-depth learning and research. However, they do have an increased development of visual ability in their cognitive functions. Game-based learning, pictures and animations would excite and stimulates them in learning.

Current educational systems must change in response to a new generation of young people. Current students have been variously described as disappointed (Oblinger 2003), dissatisfied (Levin & Arafeh 2002), and disengaged. Brown (2000), contends "today's kids are always "multiprocessing" – they do several things simultaneously – listen to music, talk on the cell phone, and use the computer, all at the same time" (p. 13). It is also argued that the new generations are accustomed to learning at high speed, making random connections, processing visual and dynamic information and learning through game-based activities. It is suggested that because of these factors young people prefer learning styles that provides burst of information in a short period, fun and able to provide them with immediate feedback.

3. SPACED LEARNING

Spaced learning is one of the pedagogical techniques that could provide the suitable learning style for the new generations. Studies of human memory have shown that we remember more when learning is spaced over time rather than crammed together in a single session (Ferguson, Barzilai, Ben-Zvi, Chinn, Herodotou, Hod, Kali, Kukulska-Hulme, Kupermintz, McAndrew, Rienties, Sagy, Scanlon, Sharples, Weller & Whitelock 2017; Rohrer & Pashler 2007). Typically, these studies have focused on learning short items, such as words or phrases in a foreign language, with increasing spaces between attempts to recall the items.

The way this is thought to work is that each recall session stimulates the learner's short-term memory for the item and its new association, until these become fixed in long-term memory. The method is generally successful, providing the student is willing to stick with it. However, the learning takes place over days and has been limited to building connections between words, phrases or images.

A few studies of human brain activity while learning have been carried out. One of these examined magnetic resonance imaging (MRI) brain scans of humans after they had tried to memorise 120 novel pictures of faces (Xue, Mei, Chen, Lu, Poldrack & Dong 2011). Initially, each face was presented to adults multiple times, followed by the next face. Next, the faces were presented in sequence, one after the other. The study showed that spacing out the faces by showing a sequence of different ones produced more activity in the part of the brain linked to face recognition than showing the same pictures multiple times.

In a study on the adaptation of horizontal optokinetic response in mice (Aziz, Wang, Kesaf, Mohamed, Fukazawa & Shigemoto 2014), it was found that 1-hour spacing time produce the highest memory retention, which lasted for one month. Traditional learning do retain memory, however the study showed that it only lasted for one week.

4. SPACED LEARNING FOR EDUCATION

In education, a few studies have shown that, gradually expanding the interval between each teaching sessions could enhance long term memory retention (Pyc & Rawson 2009). However, the results of the studies have shown mixed reviews (Roediger & Karpicke 2010). In Karpicke and Bauernschmidt (2011), they proved that by having a different sets of expanding interval schedules (short spacing, medium spacing and long spacing), it did not translate into gains in long-term retention. Repeated spaced retrieval had powerful effects on retention, but the relative schedule of repeated tests had no discernible impact.

In their study, Kelley and Whatson (2013) have designed a method for spaced teaching of a certain topic in school. The teaching consists of three 20-minute sessions, with 10-minute breaks between them.

- Session 1 (20 minutes) Teacher gives a rapid presentation of a new topic.
- Break (10 minutes) Students engage in physical activity, such as juggling or walking.
- Session 2 (20 minutes) Students actively recall key concepts from the presentation.
- Break (10 minutes) Students engage in physical activity, such as juggling or walking.
- Session 3 (20 minutes) Students apply the knowledge through problem exercises.

Kelley and Whatson ran trials of their teaching method with students aged 13–15 who were learning Biology in a UK school. In one trial, students studied an entire first Biology course through spaced learning over a period of 90 minutes. Their exam performance was compared to a control group of students who studied the course in standard lessons over four months. There was no significant difference in exam scores between students who had done spaced learning in a single day and those who studied over four months.

Spaced learning had also been implemented in medical training. In an experimental study at Hamburg University, the experiment group which had been taught using the spaced learning technique showed improvements in suturing and knot-tying performance, knot quality and knot strength (Boettcher, Boettcher, Mietzsch, Krebs, Bergholz & Reinshagen 2018). Though, there were no significant differences between control group and experiment group in terms of task time and accuracy.

5. IMPLICATIONS AND FUTURE RESEARCH

Schools and universities in some countries are sometimes so overwhelm with a certain set of syllabus that teacher have to teach in limited amount of time. At the same time, the current students have a totally different attitude to learning than the previous generations. A study is currently underway to explore spaced learning in a public university in Malaysia with students consisting of Generation Y and Z. More structured technique, types of suitable break activities and timing will be proposed in this study.

6. CONCLUSION

Spaced learning could be another alternative pedagogical strategy that could be implemented for the current generations. It would be interesting to implement this strategy on student of higher learning institutions, which currently comes from Generation Y. They love multi-tasking, group work and collaborating with each other, have a short attention span and are very tech savvy. It is hope that spaced learning would appeal to their learning needs.

As an educator, we try not discriminate our students. However, there are times that we feel we are at lost in terms of dealing with the new generations. We feel as though we fail to deliver a teaching content when all we could see in front of us are a group of students who are not focus on what is being taught, instead they focus more on their phones. It is hoped that further exploration of this study could proof (or disproof) the potential of spaced learning as a pedagogical tool for the current generations.

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